

Stock Prices, Foreign Opportunity Cost, and Money Demand in Malaysia: A Cointegration and Error Correction Model Approach

Mohd Zaini Abd Karim

Tang Boon Guan

ABSTRACT

The main purpose of this study is to investigate the relevance of stock price and foreign opportunity cost variables to the money demand function in Malaysia using quarterly data over the period of 1982:1 to 1998:2 by employing recently developed econometric techniques of cointegration and error correction modeling. To take into account the effect of Asian Financial Crisis in mid 1997 on the behavior of the demand for money in Malaysia, the sample period is divided into two sub-samples: 1982:1 to 1996:4 and 1982:1 to 1998:2. The results provide evidence that the crisis somewhat affect the behavior of the money demand. The results of the study also show that the real money balances, real income, money's own rate of return, the rate of return of alternative assets, stock prices, expected exchange rate depreciation and foreign interest rate are cointegrated suggesting the existence of a stable long run relationship among them in spite of the financial liberalization and innovation process that the Malaysian financial system has been experiencing. In addition, the results also indicate the dominance of wealth effect over substitution effect and the presence of currency substitution in Malaysia.

Keywords: stock prices; foreign opportunity cost; money demand; cointegration

ABSTRAK

Tujuan utama kajian ini ialah untuk menyiasat kerelevanan harga stok dan pembolehubah kos melepas asing dalam fungsi permintaan wang di Malaysia dengan menggunakan teknik kointegrasi dan model pembetulan ralat. Analisis dijalankan menggunakan data sukuan bagi jangkamasa 1982:1 hingga 1998:2. Bagi mengambilkira kesan krisis kawangan Asia pada pertengahan tahun 1997 ke atas gelagat permintaan wang di Ma-

laysia, sample data dibahagikan kepada dua jangkamasa; 1982:1 hingga 1996:4 dan 1982:1 hingga 1998:2. Hasil kajian menunjukkan krisis kewangan mempunyai kesan keatas gelagat permintaan wang. Hasil kajian juga menunjukkan baki benar, pendapatan benar, kadar pulangan wang, kadar pulangan asset alternatif, harga stok, penurunan nilai kadar tukaran asing dijangka, dan kadar faedah asing adalah berkointegrasi. Ini menunjukkan kejujuran hubungan jangka panjang yang stabil antara pembolehubah tersebut walaupun sistem kewangan negara mengalami proses liberalisasi dan inovasi. Di samping itu, hasil kajian juga menunjukkan kesan pendapatan adalah lebih dominan berbanding kesan penggantian dan kejujuran penggantian matawang di Malaysia.

INTRODUCTION

There are numerous empirical studies on the demand for money in Malaysia [Among others, Semudram (1982), Hamzaid (1984), Roslan and Muzafar (1987), Tan (1997), Marshdeh (1997), and Mansor (1987)]. All these studies may be categorized either as single equation studies or as a part of macro econometric models of the Malaysia economy.

In addition, the estimation technique used were either conventional, using Ordinary Least Square (OLS) estimation or using Partial Adjustment Framework except for Tan (1997), Marshdeh (1997), and Mansor (1997) which used the cointegration and error correction technique. In estimating these money demand function, time series data on variables like the nominal or real income, the rate of interest, and the rate of inflation were used. It is well documented in the econometric literature that an estimate of OLS regression model can be spurious from regressing non-stationary series with no long-run relationship or no cointegration (Eagle & Granger 1987). The estimation problems arise when time series variables like the real gross domestic product and the monetary aggregates (M1, M2 or M3) may have strong trend behavior, hence providing spurious estimation results that may lead to bias and inconsistent estimates.

Furthermore, previous studies in Malaysia ignore issues like rapid changes in financial environment, the dominance of wealth effect over the substitution effect and the currency substitution effect. It is argued that, rapid changes in financial environments such as financial innovations and the growth of equity market especially the stock market may be also affects the money demand function in Malaysia.

According to Friedman (1988), an increase in stock prices will affect

the demand for money through a positive wealth effect and a negative substitution effect. The positive wealth effect may due to three factors: first, the implied increase in nominal wealth; second, the portfolio adjustments from risky assets to safe assets; and finally, an induced rise in the volume of financial transactions which will require higher money balances to facilitate them. On the other hand, the negative substitution arises from the notion of opportunity cost of holding money, where as the increase in the equity prices makes the holdings of monetary assets less attractive. Thus there may be a shift from money to stocks.

Thornton (1998) noted that the dominance of the wealth effect over the substitution effect, i.e. an increase in the stock price means higher money holdings, requires easier monetary growth for a given target of a nominal income or inflation during periods of increasing stock market prices. By contrast, if the substitution effects dominance i.e. the increase in the stock prices means less money demand, then tighter monetary policy is needed.

The relationship between the demand for money and the expected depreciation of the exchange rate has been fully documented by earlier empirical studies such as Bahmani-Oskooee and Malixi (1991), Marash-deh (1995 and 1997) and Tan (1997). The currency substitution literature provides evidence of how the exchange rate influences the demand for money. Currency substitution postulates that when the exchange rate depreciates, it implied that the expected return from holding foreign money increases, and hence, agents would substitute the domestic currency to foreign currency.

However, according to Tan (1997), the impact of domestic currency depreciation on the domestic demand for money can be either positive or negative. The impact can be negative if the domestic currency depreciation leads public to anticipate a further depreciation, increase incentive for them to hold for foreign currency against domestic currency. On the other hand, a positive influence can result if the depreciation heightens expectation that the domestic currency would rebound, thus inducing people to hold more domestic money.

The presence of these factors like the rapid development of the financial sector and the expected depreciation of exchange rate on the demand for money may have important implications for monetary policies. The failure to incorporate these factors in the money demand function will result in model miss-specification and bias in estimation of the money demand function.

In Malaysia, the government has played very important role to attain

desirable objective such as sustainable economic growth and price stability through the Central Bank of Malaysia by using effective monetary policies. So, an accurate money demand analysis that incorporates the above mentioned issues must be undertaken to provide policy maker with correct information for their decision-making.

Hence, the primary objective of this paper is to investigate the relevance of stock price and foreign opportunity cost variables in the money demand function of a small open economy like Malaysia using quarterly data for the period 1982:1 to 1998:2.

The rest of the paper is organized as follows. Section 2 discusses the Malaysian financial system with regard to its development and the composition of the money stock. Section three reviews some empirical evidence from previous studies on the demand for money in developing countries. Section four describes the specification of the model and the data employed in this study. Section five discusses the estimation results. Finally, chapter six summarizes the findings of the study and provides some policy implications.

THE MALAYSIAN FINANCIAL DEVELOPMENTS

During the study periods, we have seen the economy going through the recession's years of 1985-1986 and the subsequent recovery of Malaysian economy after that. For the boom periods of year 1987 to 1994, the Malaysian economy achieved an average annual growth rate of about 8%. Besides that, the study period also witnessed the deregulation of interest rates on loans and deposits as well as the introduction of several measures to deregulate the financial market to make sure the market is more competitive.

Like other countries, Malaysian financial developments went rapidly including the liberalization of interest rates, financial innovations and rapid growth of capital and derivatives markets. The financial liberalization began with the deregulation of interest rates on October 1978 by allowing banks to determine their own deposit rates. This deregulation was suspended from October 1985 to January 1987 due to tight liquidity in the market and world economic recession. During this period, commercial banks were required to peg their deposit rates of up to one-year maturity to the deposit rates of the two leading domestic banks. The deregulation was resumed on February 1987. The deregulation of the interest rates created more competitive environment in the Malaysian banking industry.

In 1983, the authority introduced the base-lending rate (BLR), to which the banks were asked to peg their lending rates to. Additionally, during the period under-study, the financial markets have witnessed the introduction of several new financial products and technological changes. The new financial products include Negotiable Certificates of Deposits (NCDs), Bankers Acceptance (BAS) in 1979; non-interest bearing Government Investment Certificates (GICs) in 1983; mortgage-backed bonds in 1987; Floating Rate Negotiable Certificates of Deposits (FRNCDs) in 1988; Repurchase Agreement (Repos), Credit Cards and various Islamic financial instruments since 1983. In addition, technological changes include the introduction of Automated Teller Machines (ATMs) in the mid 1980s and Electronic banking and Tele-banking in the early 1990s.

The capital markets in Malaysia comprise of the conventional and Islamic markets for medium and long-term financial assets. The conventional markets consist of two main markets that are the equity market dealing with corporate stocks and shares, and the bond markets dealing with public and private debt securities with maturity exceeding one year. Complementing the banking system in its function as a financial intermediary, these markets have increased in importance during the period 1988 to 1999.

A strong infrastructure and a comprehensive legal, regulatory and administrative framework have facilitated the development of the capital markets. Overall, the capital markets played a significant role in the economy. In this regard, the markets allocated financial resources for economic activity and growth through promoting and mobilizing savings and in providing long-term finance for both the public and private sectors. The ratio of net funds raised in the capital markets to loans extended by banking system rose from 0.6 during 1988-97 to 3.2 in 1998.

Among the various markets, equity market is the most matured. The primary roles or functions of the equity market is to intermediate between the needs of firms and investors. In addition, it also facilitates several related functions; especially risk diversification, information acquisition about firms, corporate governance and savings mobilization.

Since the formation of the Kuala Lumpur Stock Exchange (KLSE) in 1973, the funds raised from the market, which totaled RM86.5 billion during 1988-August 1999, accounted for 46% of total funds sourced from the capital markets. Four major developments were significant during this period.

First, the failure of a listed company necessitating a three-day

suspension of trading on the KLSE in December 1985, and subsequent reforms in the form of corporatisation of the stock broking industry; establishment of the Panel on Takeovers and Mergers; as well as the setting up of an early warning unit in the KLSE. More significant was the split between the KLSE and Stock Exchange of Singapore (SES) in 1989 and the consequent emergence of the “over-the-counter” market, Central Limit Order Book International (CLOB). Nevertheless, trading in CLOB was discontinued from 16 September 1998 following the announcement of the KLSE measures to enhance transparency on 31 August 1998.

Second, modernization efforts by the KLSE were stepped up so that by early 1995, the trading system comprised the System on Computerised Order Routing and Execution (SCORE), a central order matching computer system, WinSCORE, the broker’s end trading system. Coupled with the full immobilization of counters in the KLSE through developing a central depository system, the KLSE was transformed into a world-class stock exchange.

Third, during the “super-bull” run period in 1993, the performance of the stock market was outstanding, in that share prices and turnover registered new record highs. In this regard, the KLSE Composite Index reached the all-time high record of 1,341.46 points on 5 January 1994, while the total turnover in 1993 exceeded the combined turnover for the previous two decades.

Finally, the stock market experienced its sharpest correction ever as a consequence of the Asian Financial crisis in 1997, which led to outflows of capital and the economic recession in 1998. The KLSE Composite Index closed at its lowest level in 11 years at 262.70 points on 1 September 1998. However, following the introduction of selective exchange controls and the introduction of measures to maintain systematic stability, strengthen market intermediaries, improve market transparency and corporate governance, the KLSE Composite Index turned around and increased to 738.28 points at 19 October 1999.

On the other hand, during the period 1980-1986, the average market capitalization was RM62 billion. It increased to RM74 billion in 1987 and to RM807 billion in 1996. But following the Asian financial crisis in 1997 and economic recession in 1998, the average market capitalization fell to around RM375 billion during the period 1997-98. In comparison to other markets, Malaysia was ranked twenty-third in the world in 1998, being the largest market in ASEAN and seventh in Asia.

The Government securities market had traditionally dominated the

ringgit bond market. In spite of the rapid growth of the primary market in the 1970s and 1980s, the secondary Government securities market was relatively inactive. This continued in to the decade of 1988-August 1999 on account of the holding bias created by the captive market conditions, limited supply of Malaysian Government Securities (MGS) during the period 1988-97 as well as steady and regulated yields during the period 1988-90.

The decade witnessed the setting up of the private debt securities (PDS) market to complement the Government securities and equity markets, following the policy to promote the private sector as the main engine of growth in the economy in the mid-1980s. The increasing importance of the market was reflected in its share of 35.8% of funds raised in the capital markets during the decade.

Accompanying the upsurge in the demand for capital and the development of the capital markets, was the emergence of the need for risk management facilities and hence, derivatives markets offering additional financial products. Although commodity futures were traded on the Kuala Lumpur Commodity Exchange as early as 1980, financial futures first emerged in 1995 with the introduction of the Kuala Lumpur Stock Exchange Composite Index Futures (FKLI) on the Kuala Lumpur Options and Financial Futures Exchange (KLOFFE) in 1995, and the 3-month Kuala Lumpur Inter-bank offered Rate futures on the Malaysia Monetary Exchange (MME, renamed the Commodity and Monetary Exchange of Malaysia (COMMEX) in 1996.

Establishment of the financial futures markets was initiated by putting in place the legal and regulatory framework. This involved enacting the Futures Industry Act 1993, empowering the Ministry of Finance to regulate the trading of futures contracts. The Ministry subsequently empowered the Securities Commission (SC) to regulate the industry, while KLOFFE and COMMEX were allowed to operate as self-regulatory front-line regulators. Besides setting up KLOFFE and COMMEX, the Malaysian Derivatives Clearing House Bhd. (MDCH) was established in 1995 to clear contracts traded.

LITERATURE REVIEW ON MONEY DEMAND

The study on money demand in developing countries has not yet been done extensively. One of the reasons is that the financial markets in developing countries have not yet reached a well-developed state. As a consequence, the rate of interest does not imply the real opportunity cost of holding money and also most of the researchers have a problem in obtaining the data.

However, there were several studies that have done in developing countries like Malaysia. Hamzaid (1984) used quarterly time series data for the period 1967 to 1981 to determine the effects of foreign interest rate on Malaysian money demand function by using both the OLS and Hatanaka's residual-adjusted Aitken estimation techniques. He found that in addition to real income and local interest rate, foreign interest rate also has significant effects on Malaysian money demand function. Hamzaid also studied the role of real income, interest rate, and the rate of inflation on Malaysian money demand function for the same period. The variables used in this study were M1, M2, consumer price index, gross national product and the interest rate of nine months time deposits. The result of this study showed that, for M1, the Malaysian money demand was a function of real income and interest rate. For M2, however it was not only a function of real income, interest rates but also a function of inflation rate. The demand for M2 was more sensitive to the rate of inflation than the rate of interest. In addition, the stability test indicates that the Malaysian money demand functions were unstable over time.

Mansor (1987) carried out an empirical study on the demand for money in Malaysia for the period 1967 to 1984 by using an adjustment mechanism in the model. The results showed that the Malaysian money demand influenced by real income, nominal interest rate, expected rate of inflation and the price level.

Roslan and Muzafar (1987) also conducted an empirical work to determine whether Malaysian money demand function has to use real or nominal partial adjustment model. They used time series data for the period 1961 to 1983. The variables used in this study were monetary aggregates, M1, M2, M3, consumer price index, gross national product and 3-month Treasury bill rates as proxy to the rate of interest. The results showed that Malaysian money demand function for both specifications were unstable. However, the real specification has more precise predictive power than the nominal specification. He concluded that money demand function for Malaysia could use both specifications.

Marashdeh (1995) specified the demand for money in Malaysia as a function of real income, own rate of return, interest rate on alterna-

tive assets, real effective exchange rate and lagged money balances. He reported that the demand for narrow money is influenced by income, 3-month treasury bills rate, and the lagged money balances; whereas M2 is affected by real income, own rate of return (6-month mode deposit rate), 3-month treasury bills rate and lagged money balances. The results also indicate that the real effective exchange rate has a negative impact in the short run, but it has no impact in the long run. However, the study does not check for the degree of cointegration among the variables (the presence of spurious correlation problem among the variables).

Marashdeh (1997) used the cointegration and error correction methods to estimate the Malaysian money demand (M1) with monthly data over the 1980:1 to 1994:10 period. The results suggest that the variables are significant in influencing the demand for money in Malaysia in the short run are income, expected inflation rate, the rate of return on 6-month mode deposit rate, expected depreciation of the exchange rate, seasonal dummies, and the error correction variable from the long run demand for money.

Tan (1997) also estimated the money demand function using M0, M1 and M2 to assess the role of financial developments in the structural stability of the function using quarterly data from 1973:1 to 1991:4. He specified the real money demand to be a function of real gross domestic product, money's own rate of return, rate of return on alternative assets, and the exchange rate index. The results indicate the presence of a cointegrating vector that governed the long run money demand functions. In addition, the results suggest the presence of structural instability in the long run relationships between real money demand and its determinants.

Gurley and Shaw (1960) argued that financial innovations by increasing the number of substitutes for money would increase the interest elasticity of money demand. According to *Friedman* (1988), an increase in stock prices will affect the demand for money through a positive wealth effect and a negative substitution effect. The positive wealth effect arises from the implied increase in nominal wealth, the portfolio adjustments from risky assets to less risky assets and the increase in the volume of financial transactions. On the other hand, the negative substitution arises from the notion of opportunity cost of holding money, where as the increase in the equity prices makes the holdings of monetary assets less attractive.

Bahmani-Oskooee and Pourheydari (1991) estimates the money demand function for UK by using quarterly data over the floating exchange rate period 1973 to 1987. The findings showed that the real effective exchange rate had a significant effect on the demand for money

in UK for both short run and long run. Since the long run exchange rate elasticity of the demand for money in UK was positive, it was concluded that an increase in real effective exchange rate, i.e. the depreciation of the British Pound would increase the demand for money. Hence, it has led to a decrease in the effectiveness of a given monetary policy.

Leventakis (1993) examined empirically the role of currency substitution and capital mobility in affecting money demand in major industrial countries over the floating exchange rate period. The empirical results provide evidence of capital mobility in the case of one or both monetary aggregates for all seven countries. However, the findings could not provide evidence of currency substitution in the selected countries.

Arize and Shwiff (1993) estimates the broad money demand for Japan over the period from 1973 to 1988 by using cointegration approach and error correction modeling. The empirical findings suggest that the explanatory variables that significantly influence the real broad money demand in the short run are changes in real exchange rates, inflation and interest rate spread. However, in the long run, the variables that influence money demand on real broad money are real income, wealth and real exchange rate. Their results suggest that monetary policy actions aimed at stabilizing the economy and counteracting the impact of external shocks must take into account the response of domestic money demand to these external factors.

Moghaddam (1997) estimates the M2 demand for money using an error correction model for the period 1959:1 to 1987:4 and two sub-periods 1959:1 to 1973:4 and 1974:1 to 1987:4. The findings suggested that lower interest and price elasticity for money demand in the second sample in which money substitutes proliferated or in the era of financial innovations.

Michael (1998) estimates the German money demand function quarterly over the period 1975:1 to 1996:4. The results show that money demand in German is remarkable stable. The author also suggests that the preconditions for monetary targeting in Germany still apply, as there is also a long run relationship between money and prices. This stable relationship may be a contribution to a stable European demand for money.

Obben (1998) found that narrow money is quite responsive to changes in real income and interest rate in both short run and long run. Broad money is income inelastic regardless of the time horizon. However it is interest rate inelastic in the short run but interest rate elastic in the long run. Price elasticity of money demand is negligible in the short run but

quite significant in the long run. Changes in the proportion of commercial bank assets placed in foreign money markets do not seem to affect demand for narrow money but their effect on the demand for broad money is both direct and significant.

Martin and Winder (1998) carried an empirical analysis of the demand for money in the European Union as a whole over the period 1971 to 1995, with particular focus on the impact of financial wealth. The empirical evidence shows a substantial impact on the demand for M2 and M3, but not for M1. The findings may explain the remarkable in of the broad monetary aggregates over the last decade. Hence, by taking into account the growth of wealth, the monetary expansion has been fairly modest. The evidence thus indicates that the strong increase of M2 and M3 should be attributed to portfolio investment considerations rather than to an expansionary monetary policy.

MODEL SPECIFICATION AND DATA

From previous empirical literatures, the demand for real money balances is determined by a scale variables and the opportunity cost of holding money variable (Sriram 2001). The general specification for long-term money demand function can be stated as below:

$$M/P = f(S, OC)$$

Where the demand for real balances M/P is a function of the chosen scale variable (S) to represent the economic activity and the opportunity cost of holding money (OC). M stands for the selected monetary aggregate in nominal term and P for the price level. Given the above general framework, there were a lot of issues concerning the selecting and representation of variables, modeling and estimation.

Previous literature showed that money demand has been estimated for various aggregates, their components, or certain combination of these components. Scale variable is used in the estimation as a measure of transactions relating to the economic activity. It is usually represented by variables expressing income, expenditure, or wealth concept. The price variable is selected to follow closely scale variable, although consumer price index is the most commonly used measure.

One of the most important aspects of modeling the demand for money is the selection of appropriate opportunity cost variables. The literature has shown that studies, which paid inadequate attention on this matter, will

produce poor results. There are two major ingredients: (i) own-rate and (ii) alternative return on money. The former happens to be very important, especially if the financial innovation has been taking place in an economy (Ericsson 1998). The latter involves yields on domestic financial and real assets for a closed economy, and additionally on foreign assets for an open economy. A number of instruments are available to represent the yields on domestic financial assets. Usually, the yield on real assets is proxied by the expected inflation.

On the other hand, the return on foreign assets usually represented by the foreign interest rate or exchange rate variable. As a result, prior to selecting appropriate opportunity cost variables, the researchers should pay careful attention on evaluating macroeconomic situation and developments in the financial system (including institutional details and the regulatory environment), and the degree of openness of the economy.

Economic theory provides some guidance in reference to the relationship between demand for money and its determinants. As the scale variable represents the transactions or wealth effects, it is positively related to the demand for money. The money own rate of return is expected to be positively related to the demand for money as the higher the return on money, less the incentive to hold alternative assets as money. Conversely, higher the returns on alternative assets, lower the incentive to hold money, so the coefficients of alternative returns expected to be negative.

On the other hand, the expected inflation generally has negative effect on the demand for money, as agents prefer to hold real assets as hedges during the rising inflation periods. The foreign interest rates are also expected to have negative influence on demand for money. This is because as increase in foreign interest rates potentially induce the domestic residents to increase their holding of foreign assets and reduce the local money demand. Similarly, the expected exchange depreciation will also have a negative relationship. An increase in expected depreciation implies that the expected returns from holding foreign money increase, and hence, agents would substitute the domestic currency for foreign currency.

As a consequence, the demand for money in Malaysia is assumed to depend on a scale variable and the opportunity cost variables. The measured real income as a scale variable is proxied by the real industrial production index.¹ This is due to the unavailability of either quarterly data on real gross domestic product or real gross national product. Although quarterly figures can be generated from annual data, we decide not to use such method since the possibilities of measurement errors are large in such cases. If measurement errors are correlated with the independent variables,

the use of OLS may lead to biased and inconsistent estimates. Hence, we just use the real industrial production index as a proxy to real income.

The selection of opportunity cost variable is one of the most important aspects in modeling the demand for money. The appropriate rate of return on money is saving deposit rate. The 3-month treasury bills rate is used to represent the alternative return on money because the market is sufficiently liquid in Malaysia and the data are readily available.

To account for the openness of the economy, the exchange rate variable that is represented by exchange rate index² and foreign interest rate represented by US 3-month treasury bills rate are added to the model to capture the substitution between domestic and foreign currencies. The stock price variable is also include in the model and is proxied by the Kuala Lumpur Composite Index (KLCI).

Base on the arguments, the long run money demand function be specified as follows:

$$M_t = f(Y_t, R_t, AR_t, S_t, E_t, FR_t). \quad (1)$$

Where M_t is the real balance (M_t / P_t), Y_t is the real income level, R_t is the rate of return on money, AR_t is the alternative return on money, S_t is the stock prices, E_t is the exchange rate measure, FR_t is the foreign interest rate, and P_t is the price level.

All variables are in natural logarithmic form. We employed two alternative monetary aggregates for the dependent variable M_t , namely M1 and M2. As in the theoretical models, the empirical model generally specifies the money demand as a function of real balances (Laidler 1993). Using real money balances as the dependent variable will also mean that the price homogeneity is explicitly imposed to the model. Furthermore, there are less severe econometric problems associated with using real rather than nominal balances as the dependent variable (Johansen & Juselius 1990).

The scale variable, the real income level (Y_t) is proxied by the real production index, represents the transactions or wealth effects. Hence, it is expected to be positive related to the desired money balances.

R_t , the rate of return on money is proxied by the saving deposit rate. So, the coefficient of the saving deposit rate is expected to be positive since it represents the own rate of money. Hence, the higher the return on money, the less incentive to hold alternative assets compare to holding money.

Conversely, AR_t represent the rate of return of alternative assets that proxied by the 3-month treasury bills rate. Since, the higher the returns on

alternative assets, lower the incentive to hold money, therefore the coefficient of the 3-month treasury bills rate is expected to be negative.

The coefficient of stock prices (S_t) variable can have positive or negative signs. The sign depends on whether a substitution effect or wealth effect dominates. If wealth effect is larger than the substitution effect, an increase in the stock price means higher money holdings. The economic agents would increase their demand for money balances for transaction, precautionary and speculative purposes since they became wealthier as increase in stock price. Hence, the coefficient of stock price variable is expected to be positive. On the other hand, if substitution effect dominates, increase in the stock prices means less money demand. Therefore, the coefficient of the stock price variable is expected to be negative.

The impact of exchange rate (E_t) on the domestic demand for money also can either be positive or negative. If the currency depreciation leads the public to anticipate further depreciation, then it exerts a negative influence on money demand. Furthermore, an increase in expected depreciation implies that the expected return on holding foreign money increases. As a result, agents would substitute domestic currency for foreign currency. On the other hand, if public anticipate an appreciation of exchange rate, it is expected to have a positive influence on the money demand. This is because, when appreciation of exchange rate is anticipated, the expected return on holding foreign money decreases. Hence, agents would substitute foreign currency for domestic currency.

An increase in foreign interest rates will induce domestic residents to increase their holding of foreign assets that will be financed by drawing domestic money holdings. Therefore, the foreign interest rate variable (FR_t) is expected to have negative influence on the domestic money demand (Arize 1994 & Khalid 1999). Hence, the coefficient for FR_t is expected to be negative.

Base on the above argument, the empirical money demand function use in this study is as follow:

$$M_t = f(RIPI_t, SD_t, TB_t, CI_t, ERI_t, FTB_t) \quad (2)$$

Where M_t is the real balance (M_t / CPI_t), $RIPI_t$ is the Real Industrial Production Index (1990=100), SD_t is the Saving Deposit rate, TB_t is the 3-month Treasury Bills rate, CI_t is the Kuala Lumpur Composite Index, ERI_t is the Exchange Rate Index (1990=100), FTB_t is the US 3-month Treasury Bills rate and CPI_t is the Consumer Price Index (1990=100).

For the convenient of estimation, the formulation for M1 and M2 can be rewrite as follows:

Model 1

$$\begin{aligned} \ln M_t = & \beta_0 + \beta_1 \ln RIPI_t + \beta_2 \ln SD_t + \beta_3 \ln TB_t + \beta_4 \ln CI_t + \beta_5 \ln ERI_t \\ & + \beta_6 \ln FTB_t + e_{1t} \end{aligned} \quad (3)$$

where e_{1t} is the random error which is assumed to satisfy the least square classical assumptions. To summarize, the expected sign of coefficients for the explanatory variables are as follows:

$$\beta_1, \beta_2 > 0; \beta_3, \beta_6 < 0; \beta_4, \beta_5 < \text{or} > 0$$

Equation (2) poses several technical problems. First, are the variables stationary in level? Non-stationary of data may lead to biased t-statistics and hence, results of the regression become invalid. Hence, testing for the stationary of data is a prerequisite for further analysis. Applying the Dickey Fuller (DF), Augmented Dickey Fuller (ADF), or the Phillips-Perron (PP) unit root tests can be used to determine the stationarity of data. Second, the above equation also ignores the dynamic nature of money demand. Therefore, to account for dynamics of the model, an error correction model could be specified in first difference as follow:

Model 2

(4) According to Phillips (1987), regression involving variables in level that are $I(1)$ but are not cointegrated will yield spurious results. That implies only cointegrated variables are to be used in regressions that involve variables in level. To solve this problem, a priori tests of stationarity and cointegration are needed. Both the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests are conducted to determine the integration properties of the data series. The PP test is robust in the presence of autocorrelation and heteroscedasticity.

The regression equation for the ADF test (Dickey & Fuller 1979) is given as follows.

(5)

where Δ is the first difference operator, t refer to time trend, and k is additional terms in the lagged differences for the ADF test. e_t is the regression error assumed to be stationary with zero mean and constant variance. The Phillips and Perron (1988) test is also based on equation (5) but without the lagged differences. In both tests, null hypothesis is the presence of a unit root. ($c=0$ for ADF and $c=1$ for PP). Selection of the appropriate lag is

based on the information criteria provided by the Akaike's information criterion (AIC) and Schwartz criterion (SC).

Quarterly data from 1982:1 to 1998:2 are used in this study. We end our sample at 1998:2 due to capital controls and fixed Ringgit-US Dollar exchange rate imposed by the government in September 1998. However, since quarterly data of real gross domestic product for Malaysia is not available for the whole study period, we used the real industrial production index as a proxy.³ The main sources for all of the data used in this study are the Monthly and Quarterly Bulletin (various issues) that is published by the Bank Negara Malaysia (BNM) and the International Financial Statistics published by International Monetary Fund.

EMPIRICAL RESULTS

Figure 1, 3, 5, 7, 9, 11, 13 and 15 shows the long run trends of the variables included in the money demand function. All variables are in levels. Figures 1, 3, 5, and 7 show that the log of M1, M2, RIPI, and CI respectively has an upward trend. On the other hand, Figure 9 and 11 show that the log of ERI and FTB has a downward trend. However, there is no discernible trend observed for the log of SD and TB (Figure 13 and 15). Compare with in level, the first difference log of the variables show no upward or downward trend. (Figure 2, 4, 6, 8, 10, 12, 14 and 16).

Implementation of the Johansen procedure for cointegration requires the determination of the order of integration of the variables entering the vector autoregressive (VAR) model. For this purpose, following many others studies in the literature, the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests were conducted. The results of ADF and PP tests applied to the level as well as to the first difference variables are presented in Table 1. The variables are given in column 1 and all are in logarithmic form.

Based on the results, we cannot reject the hypothesis of a unit root for the variables in level. Hence, they are not stationary. However, all of the variables are stationary in first difference showed by ADF and PP tests. Therefore, all of the variables are integrated of order one, $I(1)$.

ESTIMATES OF LONG RUN MONEY DEMAND FUNCTION

Once the order of integration is established, the search for a unique cointegration vector using sets of variables, which are integrated of the same order, is carried out. Johansen's multivariate cointegration tests

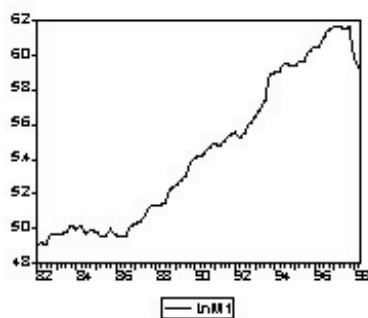


FIGURE 1

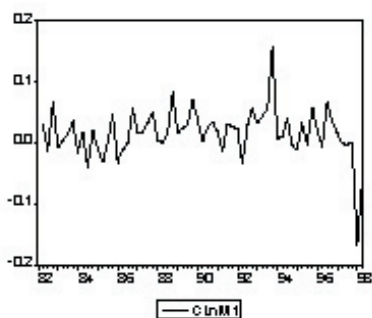


FIGURE 2

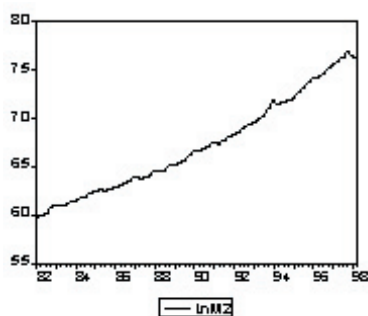


FIGURE 3

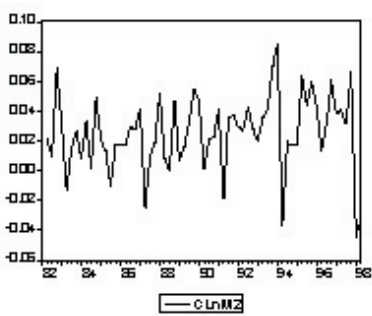


FIGURE 4

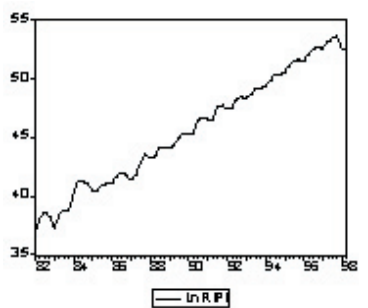


FIGURE 5

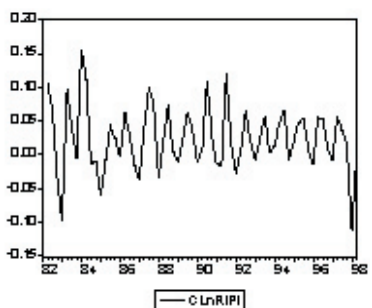


FIGURE 6

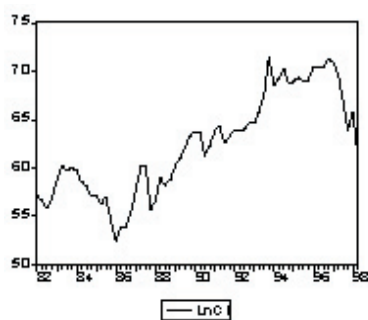


FIGURE 7

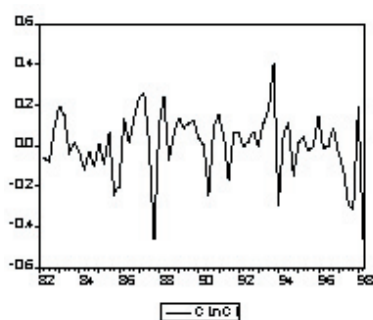


FIGURE 8

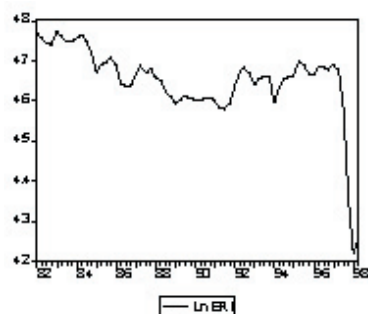


FIGURE 9

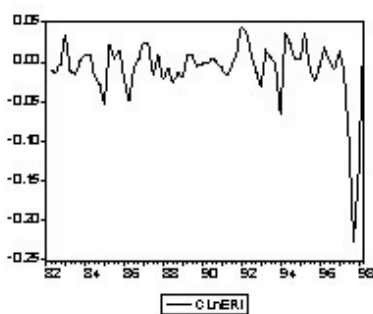


FIGURE 10

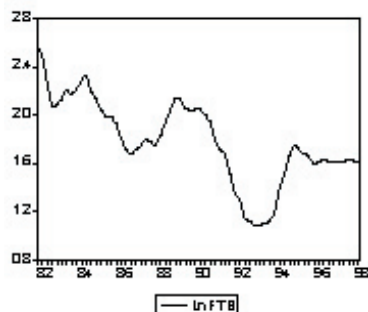


FIGURE 11

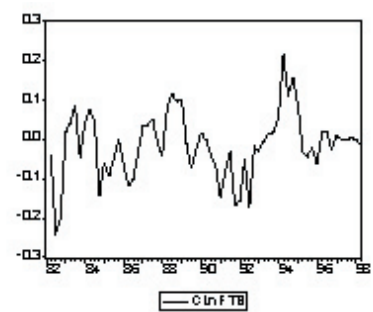


FIGURE 12

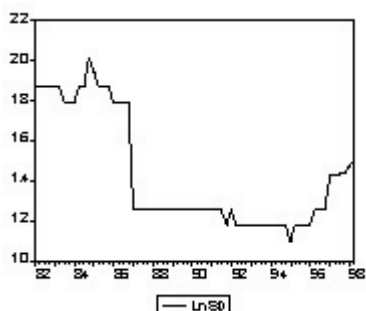


FIGURE 13

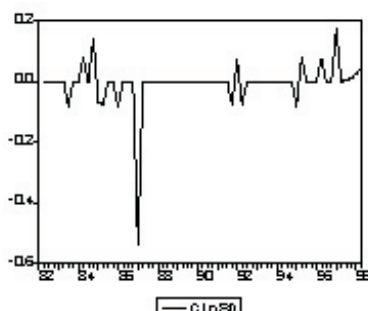


FIGURE 14

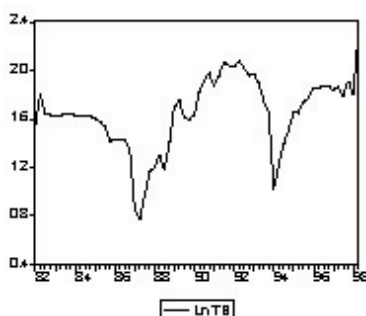


FIGURE 15

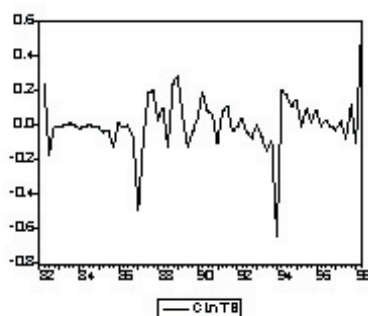


FIGURE 16

are utilized for this purpose (Johansen 1988; Johansen & Juselius 1990). This approach is preferred over the Engle-Granger two-step procedure because the Johansen's method can be used to establish the numbers of distinct cointegrating vectors and also does not have the drawbacks of the Engle-Granger approach to cointegration.

In applying Johansen technique, however, we need to decide about the order of VAR. From the literatures, when data are quarterly, a common practice is to use four lags (Choudhury 1995; Khalid 1999). The results of Johansen multivariate cointegration test are reported in Table 2 and 3 where r indicates the number of cointegrating vectors. The trace statistics for the VAR of 4 are reported in the table.

The cointegration tests were conducted first for M1 balances for 2 sub-samples: 1982:1 to 1996:4 and 1982:1 to 1998:2 to evaluate the effect of Asian Financial Crisis in mid 1997 on the behavior of the demand for

TABLE 1. Stationary test results

Variable	Augmented Dickey Fuller Test (ADF)		Phillips-Perron Test (PP)	
	Level	First difference	Level	First difference
Ln M1	-1.546191 (1) ^a	-3.434587*** (3)	-1.599926	-6.121044*
Ln M2	-1.280907 (0)	-5.060352* (2)	-1.575200	-7.048607*
Ln Y	-3.085212 (2)	-5.624373* (5)	-1.294624	-7.541965*
Ln R	-0.633243 (0)	-4.688931* (0)	-0.731868	-8.566863*
Ln AR	-2.251583 (1)	-4.455646* (0)	-2.339219	-7.816062*
Ln S	-1.030802 (0)	-3.642326** (0)	-1.546006	-7.188294*
Ln E	-2.041439 (1)	-4.836812* (1)	-1.032107	-4.542903*
Ln FR	-2.330687 (2)	-3.743229** (1)	-2.110016	-4.176328*

*, ** and *** denotes rejection of a unit root hypothesis based on MacKinnon's critical value at 1%, 5% and 10% respectively.

money in Malaysia. The results are presented in Table 2. Comparing the Likelihood Ratio (LR) test statistics with the corresponding critical values, the null hypotheses of no cointegration is rejected at the 1% level of significance. The LR test in panel (A) and (B) indicates 6 and 5 cointegrating equation at the 1% and 5% significance level for the sample 1982:1 to 1996:4 and 1982:1 to 1998:2 respectively.

The cointegration tests were then conducted for M2 balances with the same sub-sample and the results are presented in Table 3. The LR test statistics show 5 and 4 nonzero vectors in the long run demand for M2 balances for the sample 1982:1 to 1996:4 and 1982:1 to 1998:2 respectively. The results indicate a possibility of 5 and 4 stationary relationships exist between M2 balances and its determinants within the 2 sub-samples respectively.

Although, the trace tests suggest multiple cointegration vectors for M1 and M2 balances, subsequent analysis is based on only one of them i.e. the money demand function. The money demand function is based on the traditional specification where quantity of money demand is a function of scale variable and opportunity costs variables.

Ghatak et al. (1997, p. 221) argued that although the existence of multiple cointegration vectors is regarded as an identification problem for single equation cointegrating estimation, this problem, in practice, may be solved by choosing the particular cointegrating vector where the long run estimates correspond closely (in both magnitude and sign) to those

TABLE 2. Trace test for cointegrating vector (M1)
(Sample: 1982:1 to 1998:2)

Eigenvalue	Likelihood ratio	5 percent critical value	1 percent critical value	Hypothesized no. of CE(s), r
A: Sample: 1982:1 to 1996:4				
0.860519	355.2609	124.24	133.57	None**
0.824822	246.9206	94.15	103.18	At most 1**
0.651493	151.1131	68.52	76.07	At most 2**
0.550348	93.13788	47.21	54.46	At most 3**
0.406341	49.17744	29.68	35.65	At most 4**
0.306808	20.49770	15.41	20.04	At most 5**
0.006218	0.343067	3.76	6.65	At most 6
B: Sample: 1982:1 to 1998:2				
0.849550	318.7132	124.24	133.57	None**
0.756126	203.1717	94.15	103.18	At most 1**
0.574206	117.0944	68.52	76.07	At most 2**
0.420778	65.01260	47.21	54.46	At most 3**
0.318299	31.70236	29.68	35.65	At most 4*
0.127138	8.329347	15.41	20.04	At most 5
0.000569	0.034704	3.76	6.65	At most 6

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

Notes: L.R. test indicates 5 cointegrating equation(s) at 5% significance level

Test assumption: Linear deterministic trend in the data

Series: Ln M1, Ln RIPI, Ln SD, Ln TB, Ln CI, Ln ERI, and Ln FTB

Lags interval: 1 to 4

predicted by economic theory and also to those obtained by some other alternative long run estimation techniques. Other examples of using single error correction term from cointegrating equation with multiple cointegration vectors can be found in Chowdhury (1995) and Thornton (1998).

In order to derive various long run elasticities, as well as to provide economic interpretation to the cointegrating vectors, they are normalized on real money balances. This can be done by Johansen's cointegration method. The results of a unique cointegration vectors are reported in Table 4 and Table 5 for M1 and M2 respectively.

The estimated long run M1 demand function for sub-sample one (1982:1 to 1996:4) is as follow:

TABLE 3. Trace test for cointegrating vector (M2)
(Sample: 1982:1 to 1998:2)

Eigenvalue	Likelihood ratio	5 percent critical value	1 percent critical value	Hypothesized no. of CE(s), r
A: Sample: 1982:1 to 1996:4				
0.822417	275.5992	124.24	133.57	None**
0.772208	180.5418	94.15	103.18	At most 1**
0.518542	99.17898	68.52	76.07	At most 2**
0.364888	58.97744	47.21	54.46	At most 3**
0.288618	34.00996	29.68	35.65	At most 4*
0.217069	15.27995	15.41	20.04	At most 5
0.032565	1.820884	3.76	6.65	At most 6
B: Sample: 1982:1 to 1998:2				
0.758624	226.7006	124.24	133.57	None**
0.588506	139.9951	94.15	103.18	At most 1**
0.404175	85.82957	68.52	76.07	At most 2**
0.352811	54.24326	47.21	54.46	At most 3*
0.200019	27.70118	29.68	35.65	At most 4
0.159921	14.08795	15.41	20.04	At most 5
0.055113	3.458118	3.76	6.65	At most 6

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

Notes: L.R. test indicates 4 cointegrating equation(s) at 5% significance level

Test assumption: Linear deterministic trend in the data

Series: Ln M2, Ln RIPI, Ln SD, Ln TB, Ln CI, Ln ERI, and Ln FTB

Lags interval: 1 to 4

$$\text{Ln M1}_t = 5.247 + 0.496\text{Ln RIPI}_t + 0.461\text{Ln SD}_t - 0.234\text{Ln TB}_t + 0.555\text{Ln CI}_t$$

$$- 1.217\text{Ln ERI}_t - 0.085\text{Ln FTB}_t$$

The equation above indicates that the long run income elasticity of M1 is 0.496. The deposit rate that represents the money's own rate of interest also yields a positive influence on the demand for money with estimated interest rate elasticity of 0.461. In the long run, the demand for M1 is also negatively affected by 3-month treasury bills rate that represents the rate of return of alternative assets with an elasticity of -0.234 . The stock price elasticity is about 0.555, and has a positive sign. This indicates that the stock price have positive (wealth) effect on the demand for money in Malaysia. Finally, the expected exchange rate depreciation and foreign

interest rate have a negative effect on the demand for money with elasticities of -1.217 and -0.085 respectively.

On the other hand, the estimated long run M1 demand function for the second sub-sample (1982:1 to 1998:2) is shown as follow:

$$\begin{aligned} \text{Ln } M1_t = & 4.460 + 0.551\text{Ln } RPI_t + 0.573\text{Ln } SD_t - 0.196\text{Ln } TB_t + \\ & 0.515\text{Ln } CI_t \\ & - 1.076\text{Ln } ERI_t - 0.142\text{Ln } FTB_t \end{aligned}$$

The above result indicates that the long run income elasticity of M1 is 0.551. This is larger than the elasticity for the previous sub-sample. The elasticity of money's own rate is also higher (0.537) but the rate of return of alternative assets yield lower elasticity (-0.196). The elasticity of stock price and the exchange rate is also lower (0.515 and -1.076 respectively). However, the elasticity of foreign interest rate yields higher elasticity (-0.142). The comparison of the elasticities based on the two sub-samples is presented in Table 6 (Panel A).

For the case of M1 in Table 4, the normalized cointegration vector shows that the variables have the expected signs according to economic theory and the literatures.

$$\begin{aligned} \text{Ln } M2_t = & 8.419 + 0.871\text{Ln } RPI_t + 0.954\text{Ln } SD_t - 0.107\text{Ln } TB_t + \\ & 0.301\text{Ln } CI_t \\ & - 1.738\text{Ln } ERI_t - 0.357\text{Ln } FTB_t \end{aligned}$$

The estimated long run income elasticity of M2 demand is 0.871. The money's own rate and the rate of return of alternative assets also have a correct signs with the elasticities of 0.954 and -0.107 respectively. The elasticity of stock prices is 0.301 indicating that the stock price has positive influence on money demand through the wealth effect. The expected exchange rate depreciation and the foreign interest rate yield the elasticity of -1.738 and -0.357 respectively.

On the other hand, the estimated long run M2 demand function for the second sub-sample (1982:1 to 1998:2) is shown as follow:

$$\begin{aligned} \text{Ln } M2_t = & 3.528 + 1.122\text{Ln } RPI_t + 0.571\text{Ln } SD_t - 0.111\text{Ln } TB_t + \\ & 0.142\text{Ln } CI_t \\ & - 0.734\text{Ln } ERI_t - 0.017\text{Ln } FTB_t \end{aligned}$$

The equation above shows that the income elasticity for M2 is 1.122, which is higher than unity. This figure may reflect the rapid growing of

TABLE 5. Johansen's cointegration results for M2

Ln M2	Ln Y	Ln R	Ln AR	Ln S	Ln E	Ln FR	C
A: 1982:1 to 1996:4							
-1	0.87119	0.95367	-0.10694	0.30124	-1.73774	-0.35697	8.41874
(s.e)	(0.0534)	(0.1287)	(0.0365)	(0.0439)	(0.3466)	(0.0679)	
(t-ratios)		(16.314)	(7.410)	(-2.930)	(6.862)	(-5.014)	(-5.257)
Log likelihood 784.8107							
B: 1982:1 to 1998:2							
-1	1.12141	0.57093	-0.11121	0.14184	-0.73407	-0.01557	3.52771
(s.e)	(0.0288)	(0.0472)	(0.0253)	(0.0232)	(0.1457)	(0.0251)	
(t-ratios)	(42.156)	(12.096)	(-4.397)	(6.114)	(-5.038)	(-0.620)	
Log likelihood 804.6910							

Panel A and B in Table 5 presents the long run relationship between M2 and its determinants for the two sub-samples. The estimated long run M2 demand function for sub-sample one (1982:1 to 1996:4) is reproduced below:

monetization in the Malaysian economy with a more extensive branching of banking networks to remote areas and the drawing of an increasing number of rural people into the mainstream of economic development.

On the other hand, the elasticity of money's own rate is (0.571). The elasticity of the rate of return of alternative assets is also slightly higher (−0.111). The stock price still plays an important role in the money demand function with an elasticity of 0.142. Finally, the expected exchange rate depreciation and the foreign interest rate are lower (−0.734 and −0.0.17 respectively). The comparison of the two sub-samples with respect to the elasticities of the determinants for M2 is presented in Table 6 (Panel B).

When the sample includes Asian Financial Crisis periods, the income elasticities for M1 and M2 is higher (about 11.09% and 28.56% respectively). This may indicate that economic agents become more conservative, more carefully in their daily spending with the uncertainty in the economy. In other words, the real income responsiveness of money demand becomes more elastic.

The elasticity of money's own rate for M1 is 24.08% higher during the same periods. This may reflect people would pay more response to M1 (money's own rate of return) because of uncertain of economy like a sharp fall in financial and capital markets, a huge depreciation of the ringgit against the US dollar⁴, and higher inflation rate. Consequently, the rate of return of alternative assets, the stock prices and the expected exchange rate depreciation responsiveness to money demand also becomes less elastic.

However, the elasticity of money's own rate decreases about 40.15% for M2 during the crisis periods. This may be caused by the changes of economy agents' preferences to money demand and the increases in the elasticity of the rate of the alternative assets at the same period.

Finally, the elasticities of the foreign interest rate for M1 is about 67.06% higher but is about 95.52% lower for M2. The former may reflect that the increase in foreign interest rate may induce the domestic residents to increase their holding of foreign assets. The decrease in the elasticity of the foreign interest rate for M2 may indicate that the demand for M2 is not very sensitive to the change in the foreign interest rate.

ESTIMATES OF SHORT RUN MONEY DEMAND FUNCTION

We next examined the short run behavior of money demand function by estimating a dynamic error correction model (ECM). The lagged residual error derived from the cointegrating equation (3) was incorporated into

TABLE 6. The comparison of long run elasticity for two sub-samples (M1 and M2)

Variable	Elasticity					
	Y_t	R_t	AR_t	S_t	E_t	FR_t
A: M1						
(i) (1982:1 to 1996:4)	0.496	0.461	-0.234	0.555	-1.217	-0.085
(ii) (1982:1 to 1998:2)	0.551	0.572	-0.195	0.515	-1.076	-0.142
(Difference in percentage)	11.09%	24.08%	-16.67%	-7.21%	-11.59%	67.06%
B: M2						
(i) (1982:1 to 1996:4)	0.872	0.954	-0.107	0.301	-1.738	-0.357
(ii) (1982:1 to 1998:2)	1.121	0.571	-0.111	0.142	-0.734	-0.016
(Difference in percentage)	28.56%	-40.15%	3.74%	-52.82%	-57.77%	-95.52%

the general error correction model.

The dynamic model for money demand is estimated by using Hendry and Ericsson's (1991) general-to-specific modeling approach. Following this approach, the general ECM was tested down sequentially, starting by deleting the variable with the smallest t-ratio. We starting off with the following model of the ECM:

Where EC is the residuals from the cointegrating equation, D_i is the seasonal dummy variables and e_t is the error term. Finally, the parsimonious model has been identified for each of the money demand function (M1 and M2). The final estimates for M1 and M2 are reported in the Table 7 and Table 8 respectively for the sample period 1982:1 to 1998:2.

In each table, we present the results of its coefficients, standard error, and t-statistics. In addition, we also provide various diagnostics statistics to test for the appropriateness of the estimated models. This includes the Jarque-Bera (JB) test for normality; Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) test for serial correlation; ARCH LM procedure tests for autoregressive conditional heteroskedasticity (ARCH); White's Heteroskedasticity Test for heteroskedasticity; Ramsey RESET Test for specification error; and CUSUM and CUSUM of Squares tests for parameter stability.

The results for the preferred ECM for M1 are reported below:

$$\begin{aligned} \Delta \ln M1_t = & 0.0134 + 0.2949 \Delta \ln RIPI_{t-1} + 0.1220 \Delta \ln SD_t + 0.1701 \Delta \ln CI_t \\ & - 0.3491 \Delta \ln ERI_t - 0.4150 EC1_{t-1} + \text{other terms (refer Table 7)} \end{aligned}$$

(t-ratio) (2.208)** (3.051)* (2.638)** (4.969)*

(−2.483)** (−5.386)*

Notes: * and ** denotes significance at 1% and 5%.

The lagged error correction term is significant at the 1% level. In particular, the coefficient of -0.415 indicates that 41.5% of the disequilibrium is corrected within a single quarter. The short-run income elasticity of M1 demand is 0.2949. The money's own rate elasticity also significance at 5% level with elasticity of 0.122. The stock price elasticity is 0.1701 and the expected exchange rate depreciation also seems to yield a contemporaneous influence on the demand for money with the elasticity of -0.3491 .

For the M2 demand equation, the results for the preferred ECM are reported below:

TABLE 7. Error correction model for M1 (Adjusted period: 1983:2 to 1998:2)

Variable	Coefficient	Std. error	T-statistics
Constant	0.013395	0.006066	2.208164
$\Delta \text{Ln } M_{t-2}$	0.251209	0.144410	1.739556
$\Delta \text{Ln } M_{t-3}$	0.410646	0.142120	2.889441
$\Delta \text{Ln } Y_t$	0.294870	0.108463	2.718630
$\Delta \text{Ln } Y_{t-3}$	-0.384176	0.086780	-4.427022
$\Delta \text{Ln } R_t$	0.121979	0.046242	2.637846
$\Delta \text{Ln } R_{t-3}$	-0.106970	0.054594	-1.959356
$\Delta \text{Ln } R_{t-4}$	-0.158701	0.052921	-2.998823
$\Delta \text{Ln } AR_{t-1}$	0.115132	0.037073	3.105524
$\Delta \text{Ln } AR_{t-2}$	0.114344	0.033242	3.439774
$\Delta \text{Ln } AR_{t-3}$	0.097890	0.031662	3.091690
$\Delta \text{Ln } AR_{t-4}$	0.099567	0.027834	3.577202
$\Delta \text{Ln } S_t$	0.170126	0.034236	4.969155
$\Delta \text{Ln } E_t$	-0.349103	0.140599	-2.482973
$\Delta \text{Ln } E_{t-1}$	0.404976	0.152291	2.659225
$\Delta \text{Ln } E_{t-2}$	0.447120	0.147733	3.026534
$\Delta \text{Ln } FR_{t-4}$	-0.115092	0.048621	-2.367123
D3	-0.034923	0.010999	-3.175227
$EC1_{t-1}$	-0.415008	0.077052	-5.386050
R-squared	0.727	Adjusted R-squared	0.611
S.D. dependent var	0.041	S.E. of regression	0.026
Sum squared resid	0.028	F-statistic	6.226 (0.00)
Durbin-Watson stat	1.728	Jarque-Bera (JB)	1.246 (0.54)
Breusch-Godfrey LM (4)	2.523 (0.64)	ARCH (4)	7.017 (0.14)
White Heteroskedasticity	29.487 (0.73)	Ramsey RESET (1)	2.945 (0.09)

Notes: Figures in normal parentheses () refer to marginal significance levels.

$$\begin{aligned}
 \Delta \text{Ln } M2_t = & 0.0192 + 0.1922\Delta \text{Ln } RPI_{t-} - 0.0418\Delta \text{Ln } TB_t - 0.1133\Delta \text{Ln } \\
 & ERI_t \\
 (t\text{-ratio}) & \quad (4.50)^* \quad (2.719)^* \quad (-2.683)^{**} \quad (-2.030)^{**} \\
 & - 0.1529\Delta \text{Ln } FTB_t - 0.0901 EC1_{t-1} + \text{other terms (refer Table 8)} \\
 & \quad (-4.414)^* \quad (-2.452)^{**}
 \end{aligned}$$

TABLE 8. Error correction model for M2 (Adjusted period: 1981:1 to 1998:2)

Variable	Coefficient	Std. error	T-statistics
Constant	0.019210	0.004268	4.500615
DLn M_{t-3}	0.376778	0.118279	3.185513
DLn Y_t	0.192190	0.062985	3.051346
DLn Y_{t-3}	-0.141756	0.047953	-2.956133
DLn R_{t-1}	0.074563	0.029856	2.497435
DLn R_{t-4}	-0.171753	0.031437	-5.463450
DLn AR_t	-0.041814	0.015585	-2.683057
DLn AR_{t-3}	0.055837	0.017500	3.190700
DLn S_{t-1}	0.069187	0.017763	3.894953
DLn E_t	-0.113308	0.055826	-2.029638
DLn E_{t-2}	0.269269	0.064213	4.193348
DLn FR_t	-0.152867	0.034634	-4.413858
DLn FR_{t-1}	0.084998	0.036305	2.341200
DLn FR_{t-3}	0.066026	0.029742	2.219966
D3	-0.024136	0.006171	-3.911284
EC2 _{t-1}	-0.090139	0.036760	-2.452062
R-squared	0.728	Adjusted R-squared	0.638
S.D. dependent var	0.026	S.E. of regression	0.016
Sum squared resid	0.011	F-statistic	8.047 (0.00)
Durbin-Watson stat	1.548	Jarque-Bera (JB)	0.258 (0.88)
Breusch-Godfrey LM (4)	6.008 (0.2)	ARCH (4)	4.376 (0.36)
White Heteroskedasticity	20.33 (0.88)	Ramsey RESET (1)	1.285 (0.26)

Notes: Figures in normal parentheses () refer to marginal significance levels.

Notes: * and ** denotes significance at 1% and 5%.

The lagged error correction term is significant at the 5% level. In particular, the coefficient of -0.0901 indicates that 9.01% of the disequilibrium is corrected within a single quarter. The above estimates suggest that the M2 have short run income and interest elasticities of 0.1922 and -0.0418 respectively. The expected exchange rate depreciation and foreign interest rate are also statistically significant with the elasticities estimated at -0.1133 and -0.1529 respectively.

However, the alternative rate of return of money and the foreign interest rate are excluded for the general to specific ECM specification for M1 by virtue of the statistical insignificance of its' coefficients. On the other hand, for M2, the money's own rate and the stock prices are also

statistically insignificant in the short run dynamic model.

CONCLUSION

The primary purpose of this study is to investigate the relevance of stock price and foreign opportunity cost variables in the money demand function in Malaysia using quarterly data over the period of 1982:1 to 1998:2 by employing recently developed econometric techniques of cointegration and error correction modelling.

The empirical results indicate the following: first, cointegration exist between real money demand and its determinants: real income, interest rates, stock prices, and the foreign opportunity cost variables like expected exchange rate and foreign interest rate. Hence, the results suggest the existence of a stable long run relationship among the variables studied in spite of the financial liberalization and innovation process that the Malaysian financial system has been experiencing.

Second, Stock prices have a significant impact on the demand for money. This implies that the dominance of the wealth effect over the substitution effect, i.e. an increase in the stock price means higher money holdings. Thus implies that easier monetary growth is required for a given target of a nominal income or inflation during periods of increasing stock market prices.

Third, expected exchange rate depreciation also has a significant effect on money demand. These results support the presence of currency substitution in Malaysia. The presence of currency substitution has several policy implications. First, the monetary authority should take into account the impact of exchange rate on the Malaysian economy in its formulation of domestic monetary policy. Second, the presence of foreign currency accounts in Malaysia may give the Central Bank more control over the conduct of domestic policy as the Central Bank will be able to monitor the conversion of domestic money into foreign money. Third, to have better control over these balances, the Central Bank may need to impose required reserves. Finally, the Asian financial crisis has significantly affects the behavior of money demand.

NOTA

- 1 See Marashdeh, 1997.
- 2 In the money demand literatures, various measures of exchange rates have been used. These include nominal effective exchange rates (Bahmani-Oskoe,

Martin, and Niroomand 1998); real effective exchange rate (Chowdhury 1995); expected depreciation (Khalid 1999); and exchange rate index (Tan 1997).

3 See Marashdeh (1997).

4 The ringgit depreciated by about 35% against the United States dollar in 1997 and another 7.9% by the end of August 1998, causing domestic prices to increase.

REFERENCES

- Arize, A. C. 1994. A re-estimation of the demand for money in small developing economy. *Applied Economics* 26: 217-28.
- Arize, A. C. & S. S. Shwiff. 1993. Cointegration, real exchange rate and modeling the demand for broad money in Japan. *Applied Economics* 25: 717-26.
- Bahmani-Oskooee, M. & M. Pourheydari. 1990. Exchange rate sensitivity of demand for broad money and effectiveness of fiscal and monetary policies. *Applied Economics* 22: 917-25.
- Bahmani-Oskooee, M. & M. Malixi. 1991. Exchange rate sensitivity of the demand for money in developing countries. *Applied Economics* 23: 1377-84.
- Bahmani-Oskooee, M., M. Martin & F. Niroomand. 1998. Exchange rate sensitivity of the demand for money in Spain. *Applied Economics* 30: 607-612.
- Bank Negara Malaysia. *Monthly Statistical Bulletin* (various issues).
- Bank Negara Malaysia. *Quarterly Statistical Bulletin* (various issues).
- Bank Negara Malaysia. 1994. *Money and Banking in Malaysia. 35th Anniversary Edition, 1959-1994*. Bank Negara Malaysia, Kuala Lumpur.
- Bank Negara Malaysia. 1999. *The Central Bank and the Financial System in Malaysia: a Decade of Change*. Bank Negara Malaysia, Kuala Lumpur.
- Choudhry, T. 1995. Long-run money demand function in Argentina during 1935-1962: evidence from cointegration and error correction models. *Applied Economics* 27: 661-67.
- Chowdhury, A. R. 1997. The demand for money in a small open economy: the case of Switzerland. *Open Economics Review* 6: 131-44.
- Eagle, R. F. & C. W. J. Granger. 1987. Cointegration and error correction: Representation, estimation and testing. *Econometrica* 55: 251-76.
- Ericsson, N. R. 1998. Empirical modeling of money demand. *Empirical Economics* 23: 295-315.
- Friedman, M. 1988. Money and the stock market. *Journal of Political Economy* 1-17.
- Gurley, J. G. & E. S. Shaw. 1960. *Money in a Theory of Finance*. The Brookings Institution, Washington, D. C.
- Hamzaid, Y. 1984. The Malaysian demand for money: further evidence. *Jurnal Ekonomi Malaysia* 9: 79-90.

- International Monetary Fund. *International Financial Statistics* (various issues). Washington.
- Johansen, J. 1988. Statistical analysis of cointegrating vectors. *Journal of Economic Dynamics and Control* 231-54.
- Johansen, J. & K. Juselius. 1990. Maximum likelihood estimation and inference on cointegration with application to the demand for money. *Oxford Bulletin of Economics and Statistics* 52: 169-210.
- Khalid, A. M. 1999. Modeling money demand in open economies: the case of selected Asian countries. *Applied Economics* 31: 1129-35.
- Laidler, D. E. W. 1993. *The Demand for Money Theories, Evidence and Problems*. Fourth Edition, Harper Row, London.
- Lenventakis, J. 1993. Modeling money demand in open economies over the modern floating rate period. *Applied Economics* 25: 1005-12.
- Mansor, J. 1987. Inflationary expectation and the demand for money in moderate inflation: the Malaysian evidence. *Jurnal Ekonomi Malaysia* 15: 3-14.
- Marashdeh, O. 1995. The effect of the exchange rate on the demand for financial assets in Malaysia. *First Annual Asian Academic of Management Conference Proceedings*. 7-8 December, Penang, Malaysia, 156-66.
- Marashdeh, O. 1997. The demand for money in an open economy: The case of Malaysia, Paper presented at the Southern Finance Association Annual Meeting, 19-22 November, Baltimore, Maryland, USA.
- Martin, M. G. & C. A. Winder Carlo. 1998. Wealth and the demand for money in the European Union. *Empirical Economics* 23: 507-24.
- Michael, S. 1998. The stability of German money demand: not just a myth. *Empirical Economics* 23: 355-70.
- Moghaddam, M. 1997. Financial innovations and the interest elasticity of money demand: evidence from an Error Correction Model. *Atlantic Economic Journal* June, 155-63.
- Obben, J. 1998. The demand for money in Brunei. *Asian Economic Journal* 12: 109-121.
- Roslan, A.G. & S. H. Muzafar. 1987. Inflation rate and specification of Malaysian money demand function. *The Malaysian Economic Review* 24(2): 75-83.
- Semudram, M. 1982. A macro-model of the Malaysian economy, 1957-1977. *The Developing Economies*.
- Sriram, S. S. 2001. A survey of recent empirical money demand. *IMF Staff Papers* 47(3).
- Tan, E. C. 1997. Money demand amid financial sector developments in Malaysia. *Applied Economics* 1201-15.
- Thornton, J. 1998. Real stock prices and the long-run demand for money in Germany. *Applied Financial Economics* 513-17.

Sintok
Kedah D.I.